

# Advancing Planetary Protection Knowledge Through Low Cost Technologies And Space Entrepreneurship

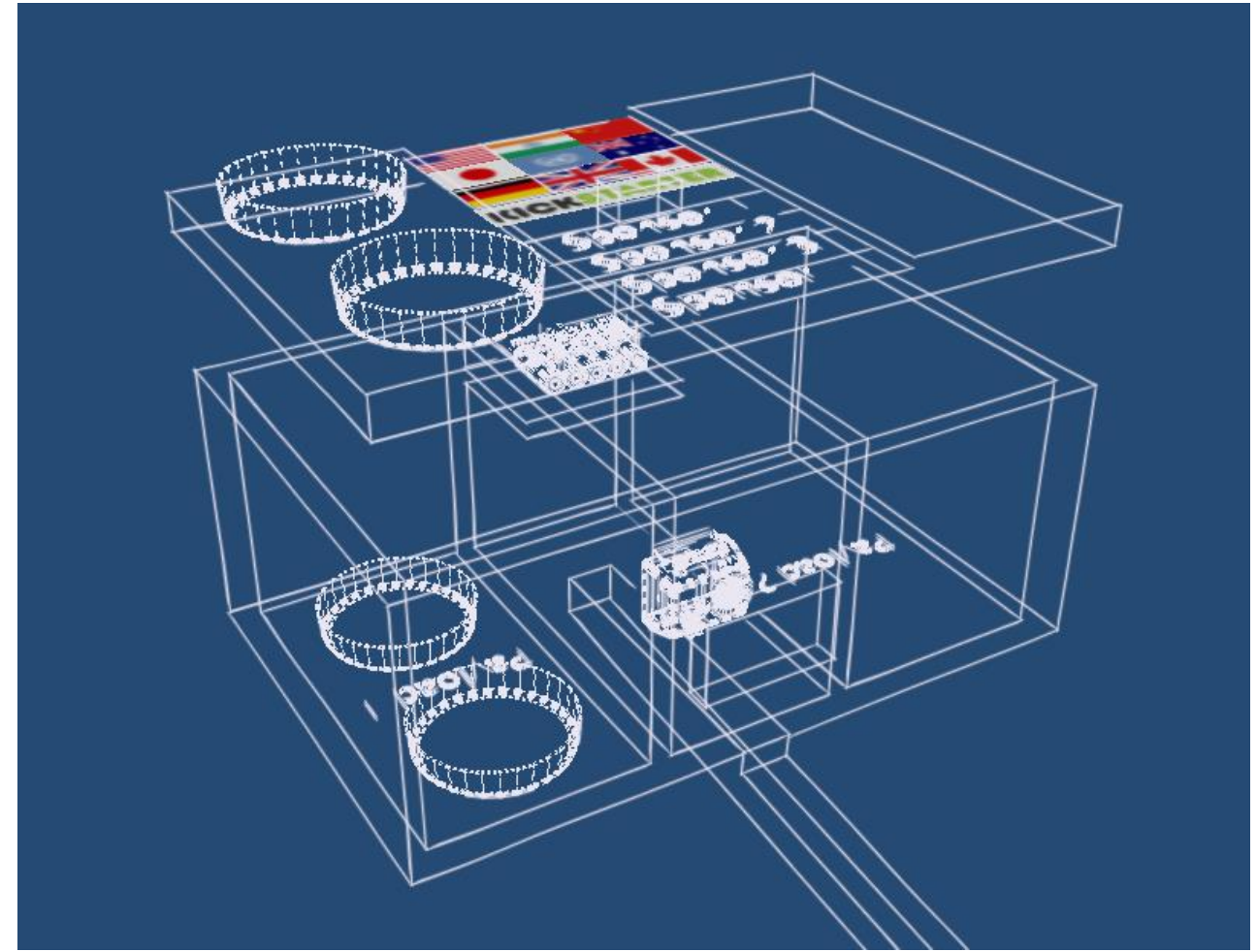
By Sam Harrison

# Shackleton 1



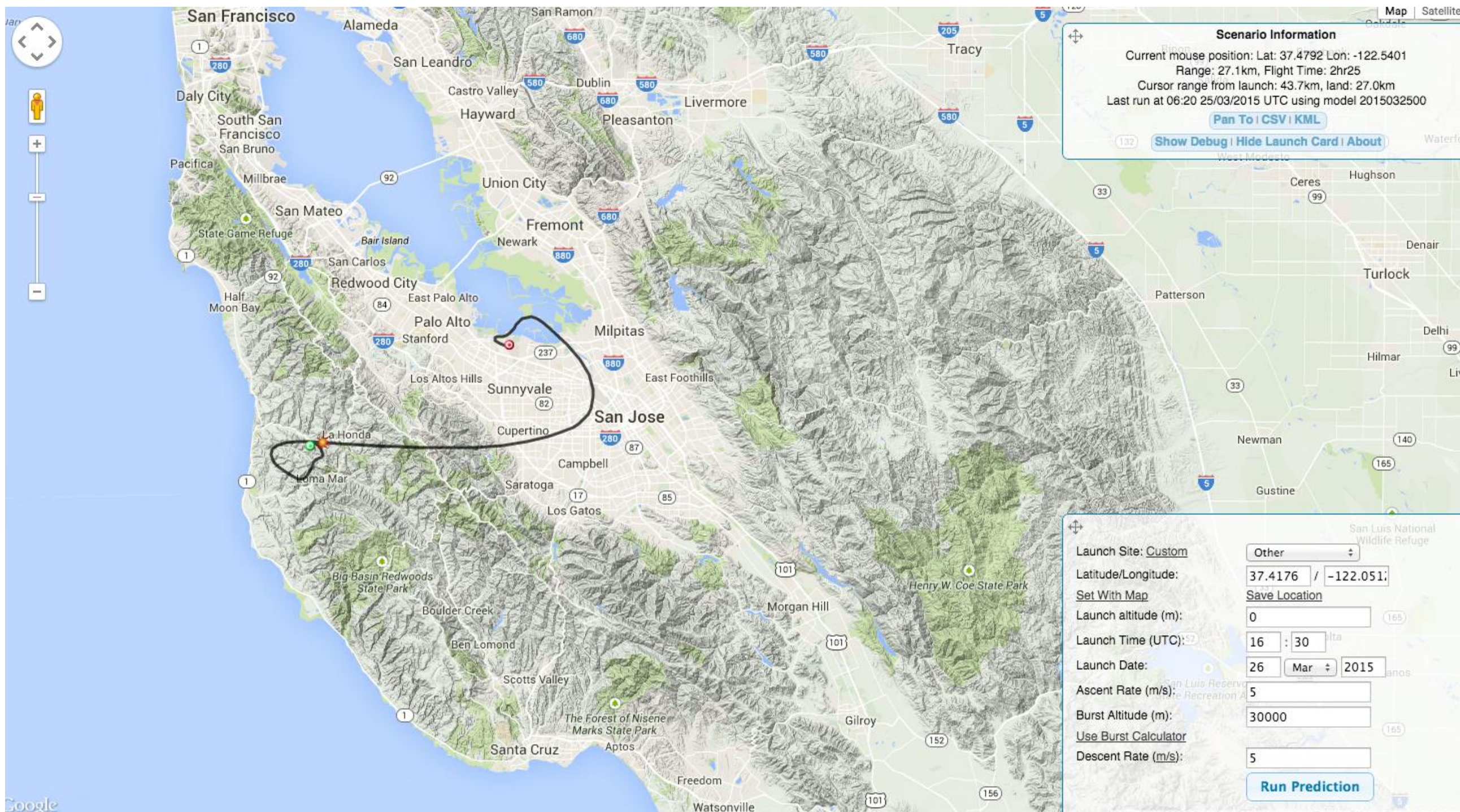


# Weather balloon payloads





# Flight path prediction





# Engineering challenges



# Shackleton 2







Footage by Shackleton 2 which was co-designed and co-launched by Sam Harrison - Study India Alumni (2014)  
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# The rise of the private sector

**SPACEX**

**MADE  
IN SPACE**

 **PLANETARY  
RESOURCES**



**URTHECAST**  
THE EARTH VIDEO CAMERA

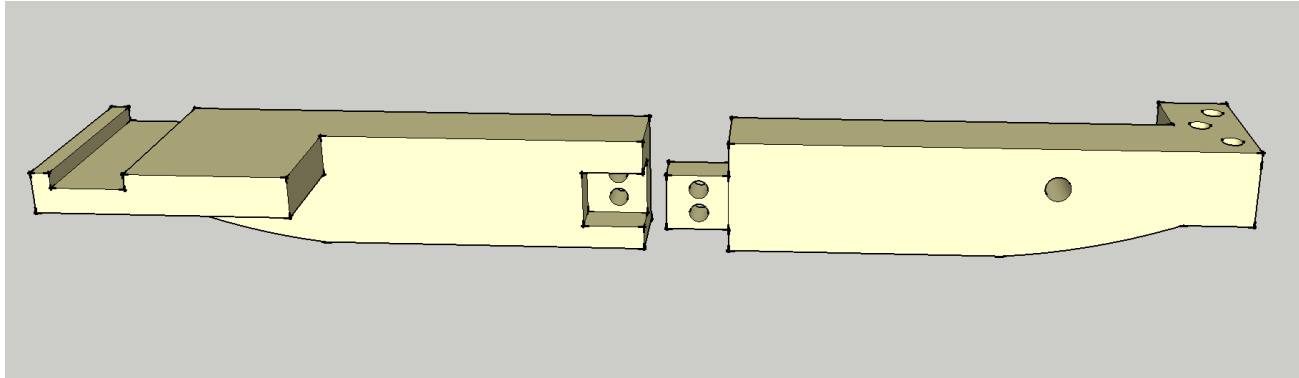


**Skybox**  
Imaging

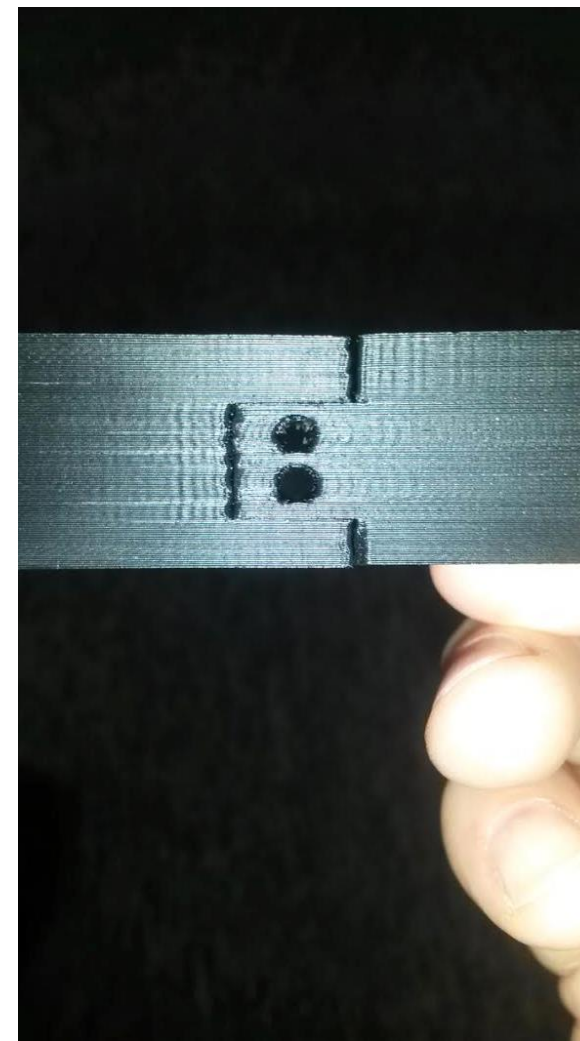




# Opportunities for collaboration



**MADE  
IN SPACE** **NEBULA**  
SCIENCES



# The environment

	Sea level	100,000ft Above sea level	Mars surface	Space
Temperature	20c	-60c	-125c to 20c	~ 273c
Pressure	1013 mbar	11 mbar	6 mbar	0 ~ mbar
Higher levels of Cosmic radiation		x	x	x
Higher levels of UV radiation		x	x	x

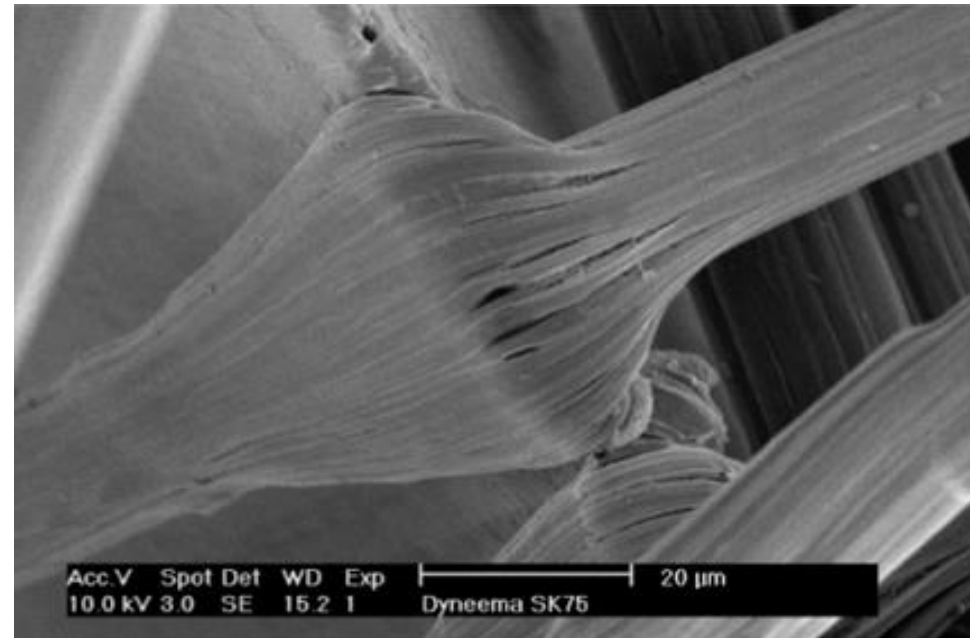


# Other Alternatives





# Extending weather balloon flight time





Next steps...



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